American Journal of Life Sciences
2024, Vol. 12, No. 6, pp. 153-156
https://doi.org/10.11648/j.ajls.20241206.15

Research Article

Seed Storage Potentiation Under Forced Ageing Condition

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Abstract

Storing of seeds is a serious problem in tropical region like Bankura and surrounding areas in West Bengal state of India where high temperature and high relative humidity greatly accelerate seed ageing. Chickpeas are a remarkable source of proteins and carbohydrates. It is also the rich supply of dietary fibre, essential amino acids and vitamins etc. It is also having no cholesterol which making them an acceptable dietary choice for individuals. The potential health benefits associated with chickpeas placed them as one of the most nutrient-dense grain legume for human consumption. Though the seeds having a lot of ethnomedicinal values but it lost viability in a quicker rate under Indian agro-climatic ambient storage condition. Pretreatment of chickpea (*Cicer arietinum* L.) seeds with aqueous solution of CCC (chlorocholine chloride, 200 μg ml^{-1}) for 4 hours before forced ageing treatment (100% RH and 32±2 ℃) for different incubations (0 to 40 days) reduced the loss of germination and field emergence capacity. The chemical also significantly arrested profuse reduction of protein as well as ageing-induced stimulation of the activity of amylase enzyme in seed during ageing. The treatments also significantly arrested profuse reduction of protein as well as ageing-induced stimulation of the activity of amylase in seed during ageing. The effect of CCC on seed potentiation is established in this study.

Keywords

Chickpea, CCC, Seed Potentiation, Forced Ageing, Catalase, Amylase

1. Introduction

Chickpea (*Cicer arietinum* L., Family: Fabaceae) is one of the cultivated highly nutritious legume crops. Chickpeas are a remarkable source of proteins and carbohydrates. It is also the rich supply of dietary fibre, lipids, essential amino acids and vitamins. It is having no cholesterol which making them an acceptable dietary choice for individuals who cannot prefer to consume animal protein. The potential health benefits associated with chickpeas placed them as one of the most nutrient-dense grain legume for human consumption. For instance, their high fibre content has the capacity to lower cholesterol levels and regulate post-meal blood sugar spikes, making them a nutritious choice for individuals managing diabetes [1].

Seed storage is a serious problem in tropical region like Bankura and surrounding areas in West Bengal state of India where high temperature and high RH greatly accelerate seed ageing phenomenon causing consequent non-viability of seeds [2-8]. Keeping in mind the problem of seed storing in our country, an attempt has been made in this investigation to prolong the storage life of a chickpea species using CCC. In fact, the treatment as imposed provides a powerful tool for studying the process of seed deterioration over a very short period in laboratory condition [9-12].

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Received: 29 August 2024; **Accepted:** 4 October 2024; **Published:** 18 November 2024

2. Materials and Methods

Surface sterilization the seed (*Cicer arietinum* L.) was dane using 0.1% $HgCl_2$ for 90 seconds. Then seeds were presoaked in aqueous solution of CCC (chlorocholine chloride, 200 µg ml^{-1}) for 4 (2+2) hours and then dried back to the original dry weight. The pretreated seed lots were taken in cloth bag and thus stored in a desiccator in which 100% relative humidity (RH) was preimposed within it. This experimental set up was kept at 32±2 ℃ for 40 days allowing the seeds to experience forced ageing.

Seed germination data were recorded following the International Rules for Seed Testing (ISTA) and field emergence capacity was recorded after 10 days of seed sowing [13]. Protein level was estimated as per standard method [14]. Extraction and estimation of the enzyme amylase activity was estimated as per the method of Khan and Faust [15, 16].

Data were statistically analysed at 95% confidence limits [17].

3. Results and Discussion

Data clearly revealed that pretreatment of the seed species with aqueous solution of CCC significantly alleviated the ageing-induced loss of germination and enhanced field emergence capacity under forced ageing environment (Table 1) and alleviated the loss of protein as well as amylase enzyme (Table 2).

The proposal that a decrease in membrane lesions might play a significant role in deterioration of seeds has been supported by the work on solute leakage accompanying a loss in germinability and viability [18-20]. Much evidence has been put forward to suggest that membrane status within the germinating embryo is an important factor in deterioration [21]. Available reports show that during seed ageing the loss of some vital cellular components including protein, carbohydrates, nucleic acids occurred [22-24]. The results therefore point out that although deterioration is a common phenomenon in treated and control samples of the experimental seed species; the catabolic processes within the treated seed samples remained somewhat subdued, thereby rendering them tolerant against unfavourable storage environment.

4. Conclusion

It can be concluded that aqueous solution of CCC is effective in enhancing storage potential of chickpea seeds and thus, the potentiation property of the present seed pretreating agent is seems to be establshed from the experimental results.

Table 1. *Effect of seed pretreatment with aqueous solution of CCC (200 µg ml^{-1}) on percentage seed germination and field emergence capacity of chickpea seeds.*

Seed sample	Treatment	Percentage seed germination			Field emergence capacity (%)		
		Days after forced ageing					
		0	20	40	0	20	40
Chickpea	Control	100	78	30	92	56	NA
	CCC	100	87	45	95	70	25
	LSD (P = 0.05)	NC	5.2	4.2	NC	4.5	-

NC: Not calculated; NA: Non attainment.

Table 2. *Effect of seed pretreatment with aqueous solution of CCC (200 µg ml^{-1}) on protein (mg/g fr. wt.) level and amylase enzyme activity (ΔODxTv/txv) of chickpea seeds.*

Seed sample	Treatment	Protein			Amylase		
		Days after forced ageing					
		0	20	40	0	20	40
Chickpea	Control	52.0	41.2	22.0	36.2	47.5	72.2
	CCC	53.0	50.0	45.0	36.1	40.2	53.0

Seed sample	Treatment	Protein			Amylase		
		Days after forced ageing					
		0	20	40	0	20	40
	LSD (P = 0.05)	NS	3.1	3.6	NS	2.8	4.5

NS: Not significant.

Abbreviations

CCC Chlorocholine Chloride
$HgCl_2$ Mercury Chloride
RH Relative Humidity
LSD Least Significance Difference

Author Contributions

Chandan Kumar Pati is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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